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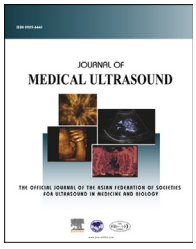

EDUCATIONAL FORUM

Renal Tumors

CME Credits

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Introduction

Renal tumors can be classified as benign or malignant. The former include angiomyolipoma, renal cell adenoma, and oncocytoma; the latter include renal cell carcinoma, urothelial cell carcinoma, and other less common primary or metastatic cancers [1,2]. This article addresses the renal tumors that are most commonly observed in a clinical setting: angiomyolipomas, renal cell carcinomas, and urothelial cell carcinomas.

Angiomyolipomas

Angiomyolipomas are benign and the most common renal tumors—found in approximately 11% of the normal population. They are composed of adipose tissue, smooth muscle cells, and blood vessels, and are typically unilateral and discovered in middle-aged women. Most angiomyolipomas are small (i.e., $<$ 4 cm in diameter) at the time of diagnosis, typically exist as a single tumor, and usually symptomless in the majority of cases. Thus, angiomyolipomas tend to be discovered incidentally during kidney ultrasound examination for other causes.

If multiple and bilateral angiomyolipomas are present in the kidneys, particularly if they are of large size ($\geq$ 4 cm), then tuberous sclerosis must be considered. Other than renal tumors, patients with tuberous sclerosis complex may have fascial sebaceous adenomas, multiorgan (brain, eye, lung and so on) benign tumors, epilepsy, and mental retardation.

Due to their fat content, angiomyolipomas usually generate an extremely strong echogenicity, have very clearly-delineated boundaries, and are therefore easy to identify. A distal acoustic shadow may be observed in some cases, so differentiation between angiomyolipoma and a renal calculus will be necessary. Because of its echogenicity, identification of an angiomyolipoma in the renal pelvis is difficult by ultrasound alone. In the event that a hyperechoic tumor $\geq$ 4 cm in diameter is observed, computed tomography is recommended to distinguish angiomyolipoma from renal cell carcinoma which may also appear as a hyperechoic structure on ultrasound.

Renal cell carcinomas

Renal cell carcinomas are the most common malignant renal tumors. A typical renal cell carcinoma possesses a clearly-defined boundary and generates a mixed ultrasound echo with hypoechoic, isoechoic, and hyperechoic signals. Hypoechoic areas usually predominate but selected isoechoic and hyperechoic areas are also present. A thin and hypoechoic rim is reported in most cases of renal cell carcinoma. Renal cell carcinomas typically arise from parenchymal tissue and are ordinarily larger than 4 cm in diameter at diagnosis. As a result, these tumors often protrude from the surface of the kidney, causing deformation of the kidney outline. Alternatively, these tumors may protrude toward the renal pelvis, causing deformation of the central sinus. Isoechoic renal cell carcinoma can be detected only via deformation of the kidney or central sinus; consequently, a small isoechoic renal cell carcinoma is extremely difficult to diagnose. Pure hyperechoic renal cell carcinoma is uncommon and often tends to be

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misidentified as angiomyolipoma. Computed tomography is therefore essential when a hyperechoic renal tumor larger than 4 cm is observed. In the case of a small hyperechoic tumor, the patient should be instructed to return for regular follow-up examinations. If no change in tumor size is observed within 2—3 years, the possibility of renal cell carcinoma can be eliminated. Since renal cell carcinoma can readily metastasize to the renal vein and inferior vena cava, attention should be paid to these areas if renal cell carcinoma is suspected.

Urothelial cell carcinomas

Urothelial cell carcinomas are malignant tumors that arise from the epithelial cells of the renal pelvis, ureter, and bladder. They are most commonly observed in the bladder, followed by the kidney and ureter. Large urothelial cell carcinomas are easily identified as hypoechoic tumors located in the hyperechoic renal pelvis. Hydronephrosis or hydrocalyx is a common complication. When the entire renal pelvis is filled with these tumors, the ultrasound appearance will be very similar to that of true hydronephrosis. In a small number of cases, urothelial cell carcinoma may infiltrate the entire kidney, causing the kidney to lose its normal structure. In that case, the entire kidney appears as a large, uniform tumor on ultrasound.

Renal pseudotumors

Many renal lesions, called renal pseudotumors, may mimic renal neoplasms on imaging [3]. Careful differential diagnosis is necessary. The first is hypertrophic renal column of Bertin. This is a congenital enlargement of a renal column and sometimes mistaken for a renal tumor. Located between the renal pyramids, the column may protrude into the renal pelvis, similar to a hypoechoic tumor. In contrast to a tumor, however, the echo from a hypertrophic renal column will be identical to that of renal parenchymal tissue and no boundary will be seen. The second is duplex kidney, in which the renal pelvis is separated into upper and lower parts by normal renal parenchymal tissue. In this situation, the normal renal tissue will resemble a hypoechoic tumor. The third is renal abscess, particularly when the abscess is not mature liquefaction. Renal abscesses often cannot be distinguished from renal tumors by ultrasound alone; clinical symptoms and other imaging methods must therefore be considered for accurate diagnosis. The fourth is renal cyst. Small renal cysts as well as renal cyst bleeding or infection may produce an internal echo that mimics renal tumors.

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